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BOOK REVIEWS.

DIE MUTATIONSTHEORIE. Versuche und Beobachtungen über die Entstehung von Arten im Pflanzenreich. Von *Hugo De Vries,* Professor der Botanik in Amsterdam. Leipsic: Veit & Comp. 1901.

Hugo De Vries, Professor of Botany in Amsterdam, especially distinguished for his investigations in the problems of heredity as well as certain other phases of botanical science, insists that the current conception of evolution, which is mainly based on Darwin's famous investigations, stands in need of important corrections. The principle *Natura non facit saltus* does not agree with facts with which all are familiar who have had much experience in horticulture—facts which any one may verify in his own garden. Professor De Vries claims that certain mutations which now and then make their appearance, are of more importance than has yet been conceded; that is to say that the development of species proceeds by "jumps" or "starts," more properly called "steps" or "mutations," and these mutations are frequently immediately productive of new species.

Darwin in his *Origin of Species* relies for explanation on two principles between which he does not always sharply distinguish. The one is mutation, a sudden change by which new species originate abruptly, the assumption of a discontinuous progress in nature by which a new species would originate immediately from a preceding one.

If the new form were distinguished from the original one by only a single characteristic, the process would clearly be a very simple one, and prior to the time of Darwin this was the point about which the controversy turned; especially the French school of the middle of the nineteenth century taking exception to the possibility of such mutations, since it was claimed that they were never observed. At that time they were acquainted with individual variations and often described them, but they saw no relation between them and the origin of new species. Our author says: "I find it impossible to understand how the actual occurence of mutations could have escaped investigators at that time, for they are lacking neither in cultivation, where they are known as single variations, nor in nature, where, as I hope to show, they closely correspond to the the expectations of the so-called transmutationists of the time."

The other principle of Darwin's selection theory is the doctrine that common individual variation can by constant selection lead to the origin of new species. This idea was quite new at the time and found many adherents, among whom Wallace was the most prominent. In fact, Wallace restated the selection theory with greater precision by eliminating entirely the principle of mutation. Single variations have, according to his opinion, no significance in the theory of descent.

Professor De Vries points out the fact that many naturalists before him, as Cope, and Semper, and Dollo, have expressed their dissatisfaction with the theory of selection as it has been quite commonly accepted since the time of Darwin, and attempts to express the method of the origin of specific characters and of descent in a way which shall be in closer agreement with observed facts.

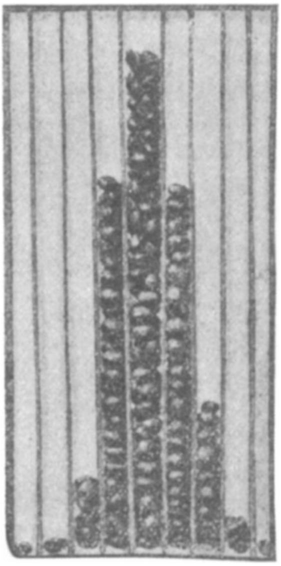

FIG. I.

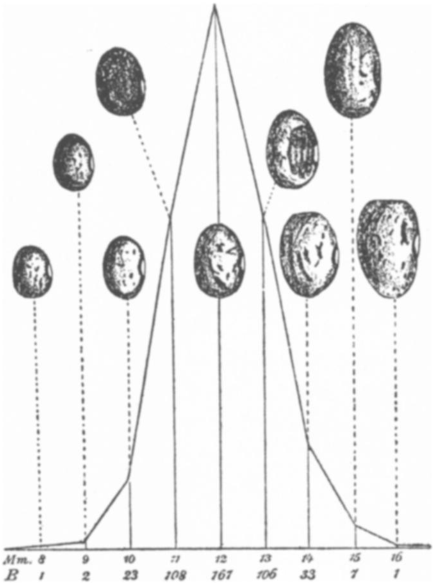

FIG. 2

Variability has of recent years been studied quantitatively by many investigators, Galton, Weldon, Bateson, Ludwig, Duncker, and others, who thus indicate the method of a more exact conception of evolution. These statistical methods are given a prominent place in the volumes before us. As an instance of this we reproduce an illustration from the work of our author showing the variability of the common red-spotted garden bean, *Phaseolus vulgaris*. Figure I shows the beans arranged according to size between glass partitions, while Figure 2 is a plotted curve showing by the length of the vertical ordinates the number of seeds of various lengths in a lot of 450 beans. It will be seen that the seeds are grouped very regularly around a mode, some longer and some shorter than the usual form, and in agreement with Quetelet's Law, according to which variation in plant and animal characteristics, and even the mental and social traits of man, are distributed in agreement with the curve of the law of the probability of error. According to the theory of Darwin or Wallace, natural forces might constantly select only the smallest seeds—that is to say might eliminate all plants not having small seeds, and so reserve · those having this characteristic—and so the species with small seeds would be evolved by the process of natural selection. The seeds of this new species would be expected to vary around a mode of much smaller seeds than those of the parent species. It might occur that more than one size of seed, for instance the largest and the smallest, would be especially adapted to the conditions under which the species grew so that both types would be preserved and two divergent species developed. But the species which exist around us now present a discontinuous series. A satisfactory theory of their origin must consider not only their kinship but their discontinuity as well. According to the theory of the selection of individual variations every series of ancestors down to the ultimate members of the family tree is supposed to be continuous in such a way as to allow between parents and children only insignificant individual differences to be explained by common variability. "But whence," asks our

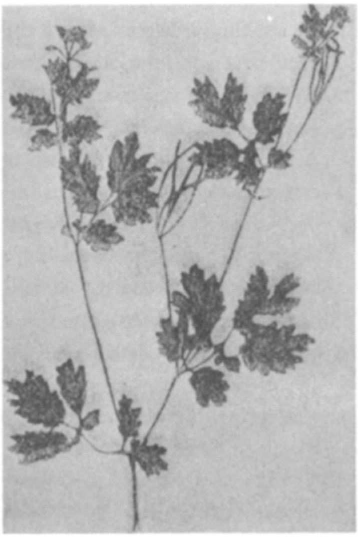

FIG. 3.

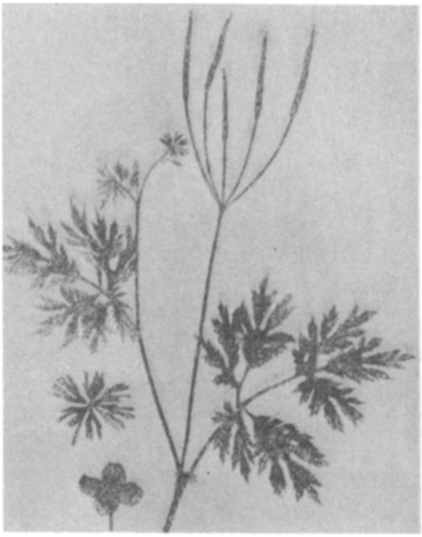

FIG. 4.

author, "are the gaps produced which separate at present all the different species so constantly and definitely from their nearest relatives?"

It is this discontinuity which he seeks to explain. We reproduce from his work two figures of *Chelidonium* The first is *Chelidonium majus,* while the second represents *Chelidonium laciniatum.* But it is known that *C. laciniatum,* distinguished from *C. majus* by its deeply cut leaves and petals, was first discovered about the year 1590 in a lot of *C. majus* growing in the garden of an Heidelberg pharmacist Since that time the new form—never found wild then or since—has been perfectly true to seed, showing no tendency to revert to the parental *C. majus.*

We also reproduce his figure of *Alnus glutinosa* and *Alnus glutinosa laciniata* which originated from it as a sudden variation. These may serve as striking illustrations of the kind of variations which Professor De Vries would designate as mutations. In common variability the series is continuous, all the forms being connected by transition stages, but in mutation there is no such connection, the mutants being sharply defined. differing from each other in the elements or the combination of the elements of which they are composed.

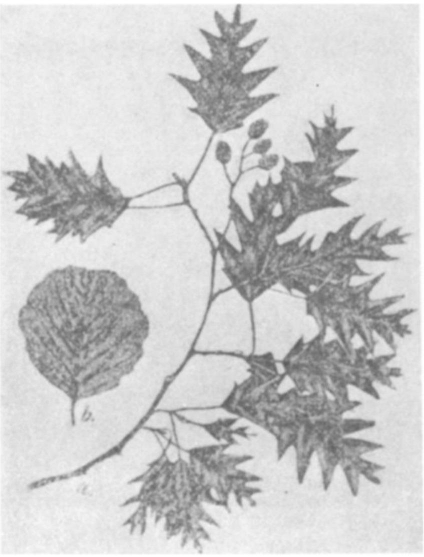

FIG. 5.

It is these mutations which Professor De Vries deems of importance in the origin of new species. Natural or artificial selection may eliminate all but certain portions of the series of uniformly differing individuals offered by common variability, and so the species may become adapted to local conditions or improved for garden purposes, but selection must be constant if the characteristics desired are to be maintained, since so soon as selection ceases to act, the species reverts to the ancestral form. With mutation this is not the case. By some physiological process not yet understood there appear in certain individuals characters, or groupings of characters, entirely different from those of the parent species, and these characters are from the first strongly hereditable, showing no tendency to revert to the parent form. As individuals of the new forms become numerous, the struggle or competition for existence between the individuals of the new species as such and also between the class of individuals representing the old and the new species, becomes severe. In the competition between the individuals of a species those least fitted to meet their life conditions will succumb in the struggle, so that local races or garden varieties, where the selective influence of man is brought to bear, are developed; but the origin of new specific characters is impossible since the modification obtainable is limited in degree and only maintained by sharp selection. In the competition between the new species and the parent species, or between the several new species which may have originated suddenly from one great species, in the course of a few years the *weaker* species will perish. It is to be assumed that of the vast numbers of species which have originated during past ages only the smallest fraction have been able to persist. In the struggle for existence species have not originated but perished.

In considering the present theory it must be borne in mind that Professor De Vries in speaking of the origin of species by mutation refers to the smallest differentiable systematic unit—small species, minor species, or specific characters and not to the groups of such units which are generally assigned the name of species. Such groups represent isolated portions of an original series of slightly differing minor species, most of which have become extinct, leaving those which remain widely separated.

Evolutionary writings have been so largely speculative that the appearance of a work presenting with the theory the evidence of many years of laborious and successful experimentation must make a profound impression. Such is the contribution before us. We cannot describe the experiments or state the results beyond saying that Professor De Vries seems to have been able to observe the origin of fixed specific characters in his cultural experiments. He feels confident that investigations in other fields will show facts analogous to those he has discovered in his study of plants ,and that the same law holds good for all forms of life.

It is difficult to form a final judgment of the significance of this voluminous and profound work, but we are impressed with the fact that Professor De Vries is a keen observer and a reliable theoriser. His propositions certainly deserve the attention of all naturalists and their merits will surely not remain hidden. P. C.

THE HAMMURABI CODE AND THE SINAITIC LEGISLATION. With a Complete Translation of the Great Babylonian Inscription Discovered at Susa. By *Chilperic Edwards.* London: Watts & Co. 1904. Pp. xiii, 168. Price, 2/6 net.

Mr. Chilperic Edwards is a well-informed scholar who in the present volume not only gives us a reliable translation of the text, but also the most indispensable expositions as to the significance of this ancient law book and